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ABSTRACT

The report describes a project designed to test the feasibility of adapting off-the-shelf educational software to a speech synthesizer compatible with Apple personal computers for visually impaired students. Fifteen visually impaired children were administered pretests and posttests for auditory discrimination, computer literacy, keyboard proficiency, spelling, and language. Students then participated in general computer literacy instruction and instruction with either the spelling or language arts program. Results revealed that software selection was difficult in that very little software lent itself to adaptation. A program was developed that successfully increased students' typing skills. Spelling and language programs were evaluated, and computer attitude measures revealed a decrease in enjoyment scores (perhaps revealing that initial scores were inflated due to unrealistic expectations about computers). With computer experience, a decrease in anxiety about computers was evidenced, along with an increase in feelings of efficacy. Extensive appendixes include copies of assessment measures, sample forms, and descriptions of the three major software programs evaluated. (CL)

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ED253018

A Project To Make Apple Computers Accessible To Blind Children

U.S. Department of Education

Grant Number: G00-83-00349
Project Number: 023LH30014
August 1, 1983 - July 31, 1984

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EC171351

I. Introduction

A revolution has occurred that is dramatically changing the way we live. Computers are here to stay and even those of us with little or no technical skills are being affected by their advent. Today, children are learning through Computer Assisted Instruction (CAI) and gaining computer literacy as early as the pre-school age. There are an estimated 200,000 computers in educational settings throughout the United States with 600,000 expected by 1985 (Market Data Retrieval, 1983). While many children are preparing for success in our computer world, visually-impaired children have been denied the experience of CAI as well as other opportunities to gain computer literacy. If continued, this lack of experience will widen the gap between these students and their sighted counterparts, needlessly compounding their disability.

A review of the current literature indicates that the Apple computer has been made to "talk" for a limited amount of software. Phillip Schwartz, president of Computer System Resources in Florida has adapted some software for the blind professional, as has David Holladay of the Raised Dot Computer Company of Pennsylvania. In addition, Peter Maggs at the University of Illinois has developed software which enables the Apple to "talk" for specific uses by blind college students.

There are also several voice synthesizers on the market that enable an Apple computer to "speak" whatever text is on the screen.

This work is primarily limited to use by visually-impaired professionals and college students rather than by the general visually-impaired populace or, specifically, visually-impaired school children. Even the voice synthesizer peripherals now available for Apple computers are of limited use because of the lack of compatible software. Thus, it was with this backdrop of issues that the present project was undertaken. The project endeavored to test the feasibility of adapting off-the-shelf educational software to a speech synthesizer unit that was compatible with the Apple II, II+, and IIe personal computers and would be within the financial reach of most school districts. The project was to then make any neccessary adaptations to the selected software and to test the efficacy of the speech synthesizer and adapted software in teaching children specific skills. The project was also concerned with the effect of the CAI in motivating the participating children to do further computer work and how it might effect their feelings about computers in general.

In general, computer literacy may be thought of as that collection of skills, knowledge, and attitudes that would allow a person to function comfortably in a computer oriented society. For the purposes of this project, computer literacy was defined as the ability to work unaided with the tested

software, and as having a positive and receptive attitude towards computers in general. The project demonstrates that this is now possible for the 41,000 school-age blind children in the United States today (Association of the Educators and Rehabilitators of the Blind and Visually Impaired, 1983).

II. Objectives of Project

Objective 1. To develop the ability to use a variety of pre-programed computer applications in an academic context. This includes the ability to understand the purpose of, and discriminate between, the different software used.

Objective 2. To foster awareness by the students of the growing role of computers in our society and of their ability to function, vocationally or personally, in such a society.

Objective 3. To use the Apple II computer to develop special software that will provide access to off-the-shelf educational software. The Apple II was chosen for this project because there were over 187,000 Apple computers in educational settings in the Fall of 1983.

Objective 4. To utilize the Echo II speech synthesizer because

of its relatively low cost, high quality and ease of installation.

Objective 5. To assess the efficacy of the Echo II speech synthesizer as used by visually impaired students with educational software.

Objective 6. To instill in students a basic understanding of the applications and the limitations of computers.

Objective 7. To use the language arts software that is currently available to sighted students through "Softswap" at the San Mateo County Office of Education, San Mateo, California.

Objective 8. To acquaint students in the project with computer training for vocational goals. Though there are currently over one million workers employed by the computer industry, this is not a career option commonly considered by visually impaired school children.

Objective 9. To disseminate the project results through journals, conferences, and invited talks.

III. Project Management

Advisory Committee.

SAF has for over eight years developed advisory committees that have played key roles in all of their programs. The present project had an advisory committee that acted as the policy and decision making component. It provided technical assistance in the areas of language development, experimental methodology, and assessment. Members of the Advisory Committee are as follows:

Ms Peggy Barker
Ms Renee Child
Ms Sandra Adams Curry
Dr. Phil Hatlen
Ms Sue Mendiara
Mr. Fred Schulenburg
Dr. David T. Uslan
Ms Elizabeth Weal

Liason and Interaction with the Selected Schools.

At the time the original proposal was submitted to the U.S. Office of Education, the San Jose Unified School District estimated that 22 visually impaired students would be available to participate in the study. However, in September, 1983, when the school district was contacted, only five children were referred by them that were able to meet the study's criteria. The Project Director contacted a number of other school districts in the Bay Area to obtain the number of subjects needed for the study. Students from the following schools

participated in the study:

El Crystal School, San Bruno;

Lawton School, San Francisco;

John Muir School, Cupertino;

Stevens Creek School, Cupertino;

Stockelmeyer School, Cupertino;

Castelerro School, Los Gatos;

San Jose Unified School District, San Jose.

Letters were sent to parents informing them of the study and requesting their consent for their child's participation in the study and release for photographs.

Follow-Up and Support.

During the last two months of the Project, the Project Director worked with teachers in the selected schools to secure their own computer system and speech synthesizer. Due to her efforts, all of the teachers have been successful in obtaining computer systems. Software was given by SAF and speech synthesizers have been ordered so the students will be able to continue with CAI in the Fall.

IV. Methods

Subjects.

The subjects for this project were 15 visually-impaired students recruited from the San Francisco Bay Area (There were originally 16 children in the project but one dropped out half-way through due to behavioral and motivational difficulties. However, the child's teacher expressed surprise that he had persevered as long as he did.). The children had varying degrees of visual impairment but had no other disabilities. Of the final 15 subjects, 7 were boys and 8 were girls.

Materials.

All subjects were administered a battery of pre- and post-tests. These were the Wepman Auditory Discrimination Test with the synthesizer speaking the words, a shortened version of the Minnesota Computer Literacy Questionnaire (see Appendix A), a standard typing test (4th Grade level), and the Stanford Achievement Tests for spelling and language (given at the appropriate grade-level for each child).

Because of the large numbers of Apple II computers in the local School systems due to the Apple Educational Program, the Apple II was chosen as the microcomputer to be used by the study. It was felt that if the students in the study were to have further exposure to computers, it would most likely be the Apple II. Therefore, using the same microcomputer would be consistent with probable future opportunities.

The speech synthesizer used in the study was the Echo II by Street Electronics. After reviewing the available speech synthesizers, the Echo II was chosen due to its compatiblity with the Apple II, its ease of use, and its cost, which was the least of all the synthesizers reviewed.

There were three different educational software packages used. These included Echotype, a typing program developed by Sensory Aids Foundation from Mastertype by Lightning Software, The Spelling Program, and The Language Program.

Procedures.

Subjects were administered the pre-tests for auditory discrimination, computer literacy, keyboard proficiency, spelling, and language. The Project Director scheduled each student for 30 minutes each per week of hands-on experience with the computer and voice synthesizer. Each student was taught to use both the hardware and software. Basic information was given each student on how a computer works. Students were allowed to explore the inside of the computer and actually feel the circuit boards. Subjects then received tutoring with an Apple II computer for 30 - 45 minutes each

week for as many as 15 weeks. All 15 subjects received instruction with the Echotype program, 10 subjects recieved instruction with The Spelling Program, and 5 received instruction with The Language Program. At the end of the instruction period, post-tests were administered

Assessment.

Because of the small number of subjects and the exploratory nature of the present study, statistical analysis of data would not have yielded meaningful results. Thus, each case was looked at individually with the goal of identifying possible trends that would suggest further research questions.

V. Results and Discussion

Because of the method of assessment and the nature of the results, the Results and Discussion sections will be combined so as to present the material more clearly. Thus, the project will be broken down by component and each will be assessed and discussed.

Efficacy of Speech Synthesizer.

One of the concerns of the project was that the selected speech synthesizer, although possessing many other desirable

attributes, would not produce speech sufficiently clear to be of use to students. This could be especially problematic with software such as the Echotype program which required students to identify accurately single words, as opposed to words in a sentence which can then be understood by using sentence structure and context as a guide. Our concerns about this matter were justified by the results of the Wepman Auditory Discrimination pre-test given to the subjects. When two words (as spoken by the speech synthesizer) were the same, students correctly identified them as such 93% of the time with a range of 80% - 100%. However, when the two words were different, students responded correctly an average of only 44% of the time with a range of 33% - 53%. These scores were clearly due to the synthesizer's lack of fidelity which made distinguishing similar sounding words extremely difficult. Our hope was that with repeated exposure to the synthesizer, students would become accustomed to the rather mechanical speech produced by the synthesizer. Indeed, this proved to be the case, although not to as great as an extent as we had expected. In the Wepman post-test, students averaged 97% correct responses to the same word pairs, with a range of 80% - 100%, and 56% correct responses to the different word pairs, with a range of 47% - 70%. However, the students only worked with the computer and speech synthesizer for a maximum of 45 minutes each week and this small amount of exposure may have limited the extent to which the students could become adjusted to the synthesized speech. The experience of the two reseachers who conducted the CAI, and who subsequently had a more prolonged

exposure to the synthesized speech, was that with more exposure one becomes more accustomed to the speech. This was supported by the Wepman post-tests, although the question remains as to what extent students would adjust to the synthesized speech given more computer time. The difficulty of unclear speech can also be compensated for, to some degree, by adjustments in the actual software, which would change the pronounciation of words which are not consistent with the phonetic rules used in programming the synthesizer.

The Wepman post-test results coupled with the clinical observations of the two researchers involved in monitoring the CAI lead us to believe that the Echo II produces speech sufficiently clear for it to be effective in CAI. However, it is a recomendation of this project that when programers are adapting software for use with the Echo II, one concern will be to insure that all the spoken text is pronounced correctly so as to facilitate the students' understanding of the synthesized speech.

Software.

The original intention of the project had been to take off-the-shelf educational software and to use it with little or no adaptation with the Echo II. We soon discovered, however, that almost without exception, educational software is very heavily graphics oriented, many to the extent that they follow a "video game" format. Thus, software selection for the project became not just simply chosing appropriate software according to its instructional content, but also according to

the format of that content. The only software that readily lent itself to adaptation was older, public domain educational software which was judged to be inadequate in terms of instructional content. Consequently, the project programer made extensive revisions of the software finally selected. This was made possible by obtaining releases from the copyright holders for one piece of software so that the changes could be made. The remaining two programs were developed by SAF due to the unsuitability for adaptation of off-the-shelf software.

Most software on the market today is protected so that a programmer may not enter the program in order to "look" at how it was written with out knowing the entry code for the particular piece. The negotiation time needed to obtain permission from the software publishers to make the necessary adaptations is often six months or more. It therefore, would be useful if writers of educational software could make available to special educators unprotected copies of their software.

Echotype.

Not only are keyboard skills necessary for a visually-impaired person to be able to use a computer, they are usually an important aspect of such a person's education as typing facilitates his or her ability to complete schoolwork. Using Mastertype by Lightning Software as a model, the project developed the Echotype typing program. Many, though not all, of the students in the project were receiving typing lessons in their special education classes. Clearly this factor confounds

the results of the typing pre- and post-tests. However, all of the students in the project showed considerable improvement in their typing skills. All the students learned the letters on the keyboard and all increased their typing speeds, one student improved from not knowing any keys on the keyboard to typing 19 words per minute with 2 errors. It is likely that the instruction recieved outside of the CAI contributed to some of the dramatic increases in student skill levels, but it clearly cannot account for all of the improvement as not all the students were recieving additional instruction. The student used as example above explicitly stated that he had been motivated by using the computer. These improvements were seen with students receiving only one 30 minute session per week of CAI. Thus, the Echotype program would seem to be an effective method for teaching typing skills and additional sessions per week would increase its efficacy. In the process of the Echotype instruction, the two monitoring researchers made notes on bugs in the software and on the actual content of the program. From these observations, as well as suggestions by the students who participated, came a number of recommendations for improving the software. Thus, the project has been able to produce a prototype, field-test it, and implement changes so as to prepare an improved piece of software for the eventual use of special educators.

The Spelling Program.

The Spelling Program was developed by the Project Programmer after he and the Project Director had done an

extensive review of the available of-the-shelf software. As with Echotype, extensive revisions were needed to make the program suitable for use with the Echo II. The overall effectiveness of this program was difficult to assess due to its use by only 10 of the students and the small incremental difference in the spelling pre- and post-test scores. Anecdotal evidence indicates that this was a program that the students enjoyed and felt motivated to use. Use of the Spelling Program by the students led to further revisions to be made so that a modified and field tested version will eventually be available to educators. This program was the students' favorite because, as one student put it, "I like this one the best because I am programming it."

The Language Program.

Due to a number of factors, this program was tested with only 5 of the students. The first was that after an extensive review of available language arts educational software, none were found which would have been suitable for adaptation to the Echo II and which also were judged to possess educational content of sufficient quality. This problem was solved by the writing of a completely original program and thus, development time was greater than that needed for the two previous programs. A second factor was that the students in the project did not move through the typing program as quickly as expected due to extremely poor typing skills. A third factor was that 5 of the students involved did not start the project until it had been under way for several weeks, thus losing a significant

amount of time (see General Comments). There was no difference between the language pre- and post-test scores, this fact being mitigated by the small number of students using the program and the short amount of time for which they did. However, the Language Program received sufficient use that a small number of revisions could be made that were suggested by observations by the two monitoring researchers.

Computer Attitudes.

One goal of the project was to ascertain the effect of CAI on the attitudes of visually impaired students concerning computers. This was done by using a shortened version of the Minnesota Computer Literacy Questionnaire. The questionnaire looked at five dimensions: Enjoyment, Anxiety, Efficacy, and Sextyping. Each dimension was rated on a scale of 5 - 25. The results of the pre- and post-tests contained some expected and some unexpected figures (see table 1).

	enjoy	anxiety	efficacy	sex
pre	24	10	17.6	14
post	22.6	7.9	17.9	19.3

Scores averaged across subjects. table 1

The first surprise was that enjoyment scores actually went down, although they still remained extremely high. This might be an indication that the original scores were inflated due to unrealistic expectations about computers. The second was that the sextype score increased, which indicates a drop in sextyping for computer use. The reason this should be a surprise is that the synthesized speech produced by the Echo II is rather masculine sounding. This was apparent to the researchers as well as to the students who remarked upon the fact a number of times. A closer look at the scores indicates that the increase is due primarily to female students who showed a proportionately greater increase in their post- versus pre-test scores as compared to the male students.

The other scores indicate that with computer experience, students anxiety about computers decreased, while their feelings of efficacy in using a computer went up, albeit slightly. Apparently then, the decrease in the enjoyment scores, perhaps due to unreasonable expectations, did not seem to have a detrimental effect on the degree of anxiety students felt about computers nor on their feelings of efficacy.

General Comments.

There were a couple of unanticipated difficulties met by the project that limited what we were originally planning to accomplish. One, discussed earlier, was that of finding appropriate software for the Echo II. Another was locating and securing the services of subjects for the study. Earlier estimations by the San Jose School District of the number of

visually impaired students proved to be rather exaggerated and cooperation promised by other school districts was not always forthcoming. These two difficulties hindered the program in that software development took longer than originally anticipated, and we were unable to recruit the number of subjects we had first proposed.

The difficulties inherent in presenting statistical results to support a project such as this one are that a) no matter what the results, they are statistically meaningless, and b) statistics inevitably fail to capture all of what occurred during such a project and thus provide only a partial description. What the numbers fail to convey is the reactions of the students and their special education teachers to the CAI. These were consistently enthusiastic, with students often being motivated to do work (such as typing lessons) on the computer that they would not do in the classroom. Among our students, motivation ran extremely high and there is no reason for us to believe that this was due to anything other than the CAI itself. Students frequently cited reasons such as "Now I'm doing what the other kids do." or even "Now I'm doing things that the other kids aren't yet." as to why they found the CAI so motivating. It should be stressed that this was despite the prototypical nature of the software being used, which meant that it was not as sophisticated, and therefore as stimulating, as most of the present educational software for sighted children.

An aspect of the project not originally apparent was the additional uses for the Echo II and the developed compatible

software. These were first suggested by the special education teachers of our students and then verified by the special education consultant on our research team. The utility of synthesized speech for computers is not limited to the visually impaired but can be applied to many learning disabilities and perhaps even mental retardation. This has two important implications for further work in this area. The first is that we are now talking about a population many times larger than that of just the visually impaired. Thus, this project could be of benefit to many more people than was first thought. The second is that, because of the involvement of a significantly larger population, there would be a greater commercial market for compatible software which could encourage development and make it more cost efficient.

The adapted and developed software is being sent to Linc in Columbus, Ohio for evaluation. There have already been a number of requests for the developed software. Parties interested in purchasing the software should contact:

Susan Phillips
Sensory Aids Foundation
399 Sherman Ave.
Palo Alto, Ca.
415-329-0430

VI. Summary of Objectives and Accomplishments

Objective 1. To develop the ability to use a variety of pre-programed computer applications in an academic context. This includes the ability to understand the purpose of, and discriminate between, the different software used.
Accomplishment: The students were taught to load and use, unsupervised, the software used in the project. Additionally, the students who used the Spelling Program were taught to make up and enter into the computer their own word lists which were saved on diskette for retrieval during later lessons.

Objective 2. To foster awareness by the students of the growing role of computers in our society and of their ability to function, vocationally or personally, in such a society.
Accomplishment: Both field reseachers talked with their students about computers and their place in our society, as well as the personal applications and vocational possibilities that they presented. The results of this are partly reflected by the Sextyping scale of the Minnesota Computer Literacy Test (see results and discussion on page 15). The field researchers discussed computer related careers with the students and several students indicated a change in career goals from a variety of professions to that of computer programmer. In addition, two students, after encouragement from Susan Phillips, Project Director, attended a computer class at the

Lawrence Hall Of Science, U.C. Berkley, in July, 1984.

Objective 3. To use the Apple IIe computer to develop special software that will provide access to off-the-shelf educational software. The Apple IIe was chosen for this project because there were over 187,000 Apple computers in educational settings in the Fall of 1983.

Accomplishment: All of the participating schools now have an Apple computer, with several having two or more. This was a concern of the project as we wished that the students involved would be able to continue their CAI after the completion of the project. All of the participating special education teachers requested and received copies of the software developed. The only item that needs to be purchased by the schools is the Echo II speech synthesizer. Some schools already have the Echo II, while others are arranging the purchase.

Objective 4. To utilize the Echo II speech synthesizer because of its relatively low cost, high quality and ease of installation.

Accomplishment: Discussions with the students, teachers and parents involved in this project indicate that all were satisfied with the Echo II. Several parents with home personal computers indicated their intent to purchase an Echo II, as did some of the schools.

Objective 5. To assess the efficacy of the Echo II speech synthesizer as used by visually impaired students with

educational software.

Accomplishment: The students' understanding of the Echo II speech was assessed by observation and the Wepman Listening Test (see page 10). Our results indicate that with increased exposure to the Echo II, comprehension of its speech increases to the point were it becomes a viable method.

Objective 6. To instill in students a basic understanding of the applications and the limitations of computers.

Accomplishment: Both field researchers spoke to the students about the limitations of computers. For example, students were told that "Computers can only do what you tell them," or "Computers really aren't smarter than people, they only think faster." This was reinforced for the students who used the Spelling Program as they learned to "program" the computer by entering in their own word lists. It was explained to them that only they, and not the computer, could generate those lists.

Objective 7. To use the language arts software that is currently available to sighted students through "Softswap" at the San Mateo County Office of Education, San Mateo, California.

Accomplishment: Master Type, developed by Lightning Software and published by Scarborough Systems, was adapted for use by visually impaired children. Master Type has been the best-selling typing tutorial software for the past year. SAF received a release on an earlier version of this program so

that the programmer under contract to SAF could adapt it for use by visually impaired children. The resulting software was used by all the students in the project. In addition, the programmer, project assistant, and project director spent several sessions evaluating language arts software at Softswap. Although none of the reviewed software was judged to be appropriate, the sessions were most helpful in setting criteria for the two subsequent programs that were developed (see discussion of Software, page 11).

Objective 8. To acquaint students in the project with computer training for vocational goals. Though there are currently over one million workers employed by the computer industry, this is not a career option commonly considered by visually impaired school children.

Accomplishment: Both field researchers discussed vocational opportunities in the computer industry with their students. The results of this discussion were reflected in the changing career goals that many of the students expressed. In addition, three children from the Lawton School in San Francisco were interviewed by KGO TV Bay Area News and their interest in computer-related careers were expressed.

Objective 9. To disseminate the project results through journals, conferences, and invited talks.

Accomplishment: Articles are currently being prepared for submission to The Journal of Visual Impairment and Blindness, and Teaching Exceptional Children. Presentations about the

project have been made throughout the duration of the project. The following is a listing of such:

October, 1983. Computer Using Educators, San Jose, Ca.

November, 1983. EdCompCon, San Jose, Ca.

Feburary, 1984. Social Psychology of Physical Differences. Invited lecturer at Stanford University, Stanford, Ca.

March, 1984. West Coast Computer Faire, San Francisco, Ca.

June, 1984. KGO TV Channel 7 news, San Francisco, Ca. (A copy of the video accompanies this report.)

July, 1984. Stanford University Microcomputer Institute for Teachers, Stanford, Ca.

Additional presentations of results are currently planned:

October, 1984. Computer Using Educators, San Jose, Ca.

November, 1984. EdCompCon, San Jose, Ca.

November, 1984. Article will appear in The Optometry Times.

VII. Recommendations

1) Include the correct word pronounciation as a programing goal when developing compatible software for the Echo II.

2) Request the developers of educational software to provide unprotected copies of their programs to special educators so as to facilitate the development of compatible software for the Echo II.

3) Explore further the potentials of synthesized speech with computers for CAI of other disabled groups of school children, such as learning or developmentally disabled children.

4) Provide subjects in future projects with full-time access to computer terminals and software.

5) Develop more appropriate diagnostic screening devices for listening skills requisite for auditory computer output.

VIII. Conclusion

As a result of this project, 15 visually impaired students in the San Francisco Bay Area had the same opportunity as their sighted peers to use a computer. Our society is moving with increasing speed into the computer era and with the aid of projects like the present one, the visually impaired will be able to share in the new technology. Early exposure to computers is an important factor in motivating children to do further work with computers and to consider computer related careers. For the visually impaired or blind child this also means another opportunity to participate in mainstream society.

As one student in the 4th grade said, "I feel more a part of the kids in my regular classroom because I can do the same stuff they can with a computer using the voice synthesizer."

APPENDICES

Appendix A	Minnesota Computer Literacy Test
Appendix B	Wepman Word Discrimination Test
Appendix C	Standard Typing Tests
Appendix D	Stanford Achievement Test (Sample test included)
Appendix E	Members of the Advisory Committee
Appendix F	Parent Permission Letter for children to participate in the project
Appendix G	Minutes of the Advisory Committee meetings
Appendix H	Photos of blind children
Appendix I	Letters Received from participating students
Appendix J	Software Descriptions Echotype Spelling Program Echotext
Appendix K	SAF Quarterly Journal, March, 1984
Appendix L	Article from Instructor, April, 1984

Appendix A

Minnesota Computer Literacy Test

Minnesota Computer
Literacy Test

DIRECTIONS: Indicate how much you AGREE or DISAGREE with each of the following statements by circling the appropriate letter. Circle "a" if you STRONGLY DISAGREE with the statement. Circle "b" if you DISAGREE with the statement a little. Circle "c" if you are UNDECIDED about whether you agree or disagree with the statement. Circle "d" if you AGREE with the statement a little. Circle "e" if you STRONGLY AGREE with the statement.

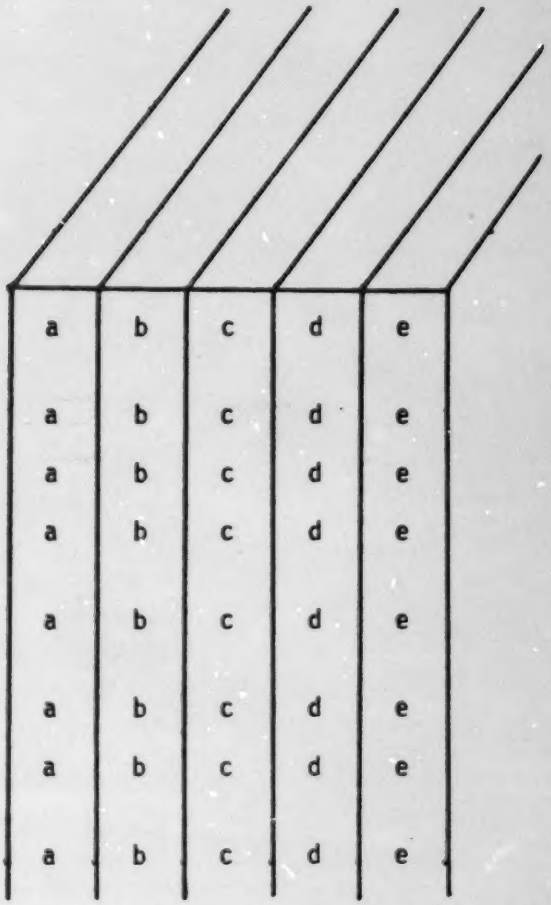
As an example, if you AGREE a little that computers are noisy, then circle "d" as shown below:

Computers are noisy a b c (d) e

Or, if you are UNDECIDED about whether computers are noisy, circle "c" as shown below:

Computers are noisy a b (c) d e

If you have any questions, ask your teacher.



1. I would like to learn more about computers...	a	b	c	d	e
2. Working with a computer would probably make me feel uneasy or scared	a	b	c	d	e
3. I don't know what to do around a computer....	a	b	c	d	e
4. Computers sometimes scare me.....	a	b	c	d	e
5. I would very much like to have my own computer.....	a	b	c	d	e
6. I would like the idea of taking computer classes.....	a	b	c	d	e
7. I enjoy using computers in my classes.....	a	b	c	d	e
8. Walking through a room filled with computers would make me feel scared.....	a	b	c	d	e

9. I feel scared when I am with people talking about computers.....	a	b	c	d	e
10. I enjoy working with computers.....	a	b	c	d	e
11. I feel good about my ability to use computers.....	a	b	c	d	e
12. I don't think I am the kind of person that works well with computers.....	a	b	c	d	e
13. I am able to work with computers as well as most others my age.....	a	b	c	d	e
14. Computers are gaining too much control over people's lives.....	a	b	c	d	e
15. In general, girls can do just as well as boys in computer jobs.....	a	b	c	d	e
16. More girls than boys have the ability to become computer specialists.....	a	b	c	d	e
17. Using computers is more for boys than for girls.....	a	b	c	d	e
18. Studying about computers is just as important for girls as for boys.....	a	b	c	d	e
19. Boys make better scientists and engineers than girls do.....	a	b	c	d	e
20. Putting phoney information in computers is a bad thing.....	a	b	c	d	e

Appendix B

Wepman Word Discrimination Test

3. Wepman

Appendix B

Auditory Discrimination Test - Form I

3.1 Student is told he will hear two words and he will tell if they are the same or different.

3.2 Examples are to be given to the student: "Listen to these words. Are they the same or different? Down - Clown. Yes, down and clown are different. Truck - Truck.....Yes, truck and truck are the same."

3.3 Play the entire tape. Record answers in columns by using checkmarks (✓). X column = different. Y column = same.

3.4 Count the number of correct 'X' scores (different) and number of correct 'Y' scores (same) and record on bottom of sheet and on Data Summary Sheet.

		Different X	Same Y
1.	tub - tug		✓
2.	lack - lack	✓	
3.	web - wed		✓
4.	leg - led		✓
5.	chap - chap	✓	
6.	gum - dumb		✓
7.	bale - gale		✓
8.	sought - fought		✓
9.	vow - thou		✓
10.	shake - shape		✓
11.	zest - zest	✓	
12.	wretch - wretch	✓	
13.	thread - shred		✓
14.	jam - jam	✓	
15.	bass - bath		✓
16.	tin - pin		✓
17.	pat - pack		✓
18.	dim - din		✓
19.	coast - toast		✓
20.	thimble - symbol		✓

		Different X	Same Y
21.	cat - cap		✓
22.	din - bin		✓
23.	lath - lash		✓
24.	bum - bomb		✓
25.	clōthe - clōve		✓
26.	moon - noon		✓
27.	shack - sack		✓
28.	sheaf - sheath		✓
29.	king - king	✓	
30.	badge - badge	✓	
31.	pork - cork		✓
32.	fie - thigh		✓
33.	shoal - shawl		✓
34.	tall - tall	✓	
35.	par - par	✓	
36.	pat - pet		✓
37.	muff - muss		✓
38.	pose - pose	✓	
39.	lease - leash		✓
40.	pen - pin		✓

Correct Score X [37] Y [40]

SPECIFIC INSTRUCTIONS

4. Auditory Reception

4.1 Tell the student he will be asked a number of questions and that he is to answer 'yes' or 'no'.

4.2 Insert tape and play demonstration I. Correct errors and give feedback on correct responses. Play tape.

4.3 Use slash mark (/) to indicate incorrect answers. Bold block Y or N is correct answer.

4.4 Continue testing until student misses 3 items in any block of seven questions.

Examples of 3 failures in block of 7:

~~8~~	~~4~~	21
9	5	22
10	6	23
~~11~~	7	24
12	8	~~25~~
13	~~9~~	~~26~~
~~14~~	~~10~~	~~27~~

4.5 Record the number of items which were correctly answered. Do not include demonstration items in score.

4.6 Items for Auditory Reception on next page (for reference).

BASAL: 5 CONSECUTIVE SUCCESSES
CEILING: 3 FAILURES IN 7 ITEMS

AUDITORY RECEPTION

SCORE

DEMONSTRATION I																				
a.	Y	N	9.	Y	N															
b.	Y	N	10.	Y	N	18.	Y	N	29.	Y	N	40.	Y	N						
c.	Y	N	DEMONSTRATION II			19.	Y	N	30.	Y	N	41.	Y	N						
1.	Y	N	a.	Y	N	20.	Y	N	31.	Y	N	42.	Y	N						
2.	Y	N	b.	Y	N	21.	Y	N	32.	Y	N	43.	Y	N						
3.	Y	N	11.	Y	N	22.	Y	N	33.	Y	N	44.	Y	N						
4.	Y	N	12.	Y	N	23.	Y	N	34.	Y	N	45.	Y	N						
5.	Y	N	13.	Y	N	24.	Y	N	35.	Y	N	46.	Y	N						
6.	Y	N	14.	Y	N	25.	Y	N	36.	Y	N	47.	Y	N						
7.	Y	N	15.	Y	N	26.	Y	N	37.	Y	N	48.	Y	N						
8.	Y	N	16.	Y	N	27.	Y	N	38.	Y	N	49.	Y	N						
			17.	Y	N	28.	Y	N	39.	Y	N	50.	Y	N						

Appendix C

Standard Typing Tests

gave to Cm grapes

Appendix C

Typing Assessment...Co. Spelling Guide'
Levels 13-16 Grade 4

1. Did you crack the fresh crab?
2. The plot is the plan for a story.
3. The staff swam at school.
4. Don't squish the shrimp.
5. She wanted to ask about the prism.
6. Tilt the plank toward the stump.
7. Ride on the side by the rod.
8. The bycycle is a different color.
9. The sheep rested on the steep trail.
10. Did the beast steal the lean meat?
11. Add an egg to the pie.
12. The lady fed candy to the pony.
13. We can go Saturday or Sunday.
14. Bob blames his shape on candy.
15. She'll come back at two o'clock.
16. One ounce of ice will melt fast.
17. The gas in his car was nil.
18. Are there taxes on those dishes?
19. Pause for a glimpse of that house.
20. The fireworks went off like clockwork.
21. Dad could outwork anyone without even trying.
22. Did the snake slither into the shed?
23. She moped because she hated her dinner.
24. The grammar lesson must be written.
25. The hammer is under the ladder.

Levels 13-16 Grade 4 Cont'd.

26. I try to fry good meat.
27. She paid me twelve dollars and ninety-two cents.
28. Is the funny boy crazy?
29. That wouldn't make sense to me.
30. Your clothes are close toyyour bed.
31. The maiden had golden hair.
32. Mother said nothing to comfort me.
33. I want to whisper to a whale.
34. The incoming flight is welcome to land.

Appendix D

Stanford Achievement Test

Appendix D

For Language and Spelling testing the following tests were used:

The Stanford Achievement Tests Primary Levels II and III, Form A (4-2440 and 6-2234) by Richard Madden, Eric F. Gardner, Herbert C. Rudman, Byorn Karlsen and Jack C. Merwin and published by Harcourt Brace Jovanovich, Inc. Printed in large print and in braille by the American Printing House for the Blind, Louisville, Kentucky.

The Stanford Achievement Tests were given to each child at the appropriate grade level and in large print for the partially sighted or in braille for the totally blind student.

Copies of these tests are available in the Project files. A spelling test (5th-6th grade) is included as an example.

5-6?

TEST 7: Spelling Part A

STEPS TO FOLLOW (Question 1-8)

I. Read each group of phrases. Look at the underlined word in each phrase. One of the underlined words is misspelled for the way it is used in the phrase.
II. Find the word that is *not* spelled correctly.
III. Draw a line through the number by the word you have chosen.

SAMPLE

A
1 no school today
2 meet at the bus
~~3~~ a honey be
4 the two dogs

1
1 a sunburned nose
2 she red a book
3 do it for him
4 a grizzly bear

2
5 the wind blew
6 tie a knot
7 the fairy princess
8 an aunt hill

TEST 7: Spelling Part A (Continued)

3	1	the music lesson
	2	around his waist
	3	a steel bridge
	4	throne a ball
4	5	go to school
	6	it is hear
	7	so nice
	8	wrote a letter
5	1	road a bike
	2	must come
	3	pair of shoes
	4	our house
6	5	close the door
	6	load the car
	7	a pain in her arm
	8	a whole in the ground
7	1	rays of light
	2	due at the library
	3	toe the car
	4	a flow of water

TEST 7: Spelling Part A (Continued)

8 5 have warn shoes
6 the dog's tail
7 raise your arm
8 three days of vacation

Appendix E

Members of the Advisory Committee

Making Apple Computers Accessible
To Blind Children

Advisory Committee

Ms Peggy Barker, Manager — 415/327-4800
Communication Service Research
Children's Hospital at Stanford
Rehabilitation Center
520 Willow Road
Palo Alto, CA 94303

Ms Renee Child — 415/321-7082
Teacher of the Visually Impaired
253 Yale Road
Menlo Park, CA 94025

Ms Sandra Adams Curry — 415/321-8131
Vice President, AEVH
208 Durham Street
Menlo Park, CA 94025

Dr. Phil Hatlen — 415/469-1080
Professor of Special Education
Department of Special Education
San Francisco State University
1600 Holloway Avenue
San Francisco, CA 94132

Ms Sue Mendiara — 415/588-1073
Resource Teacher
El Crystal School
201 No. Balboa Way
San Bruno, CA 94066

Mr. Fred Schulenburg — 408/996-3127
Parent
6128 Rainbow Drive
San Jose, CA 95129

Dr. David T. Uslan — 916/445-1290
California State Department of Education — 916/445-5103
721 Capitol Mall
Sacramento, CA 95814

Ms Elizabeth Weal — 408/554-5190
Publications Manager
Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

Appendix F

Parent Permission Letter for Children to Participate in the Project

December 7, 1983

Dear Parents:

We are writing to you at this time to describe a new program being offered to your child by Sensory Aids Foundation in cooperation with your child's teacher. Sensory Aids Foundation (SAF) is a non-profit corporation which puts technology to work helping disabled persons enter the job market by strengthening or replacing a sense that has been lost or diminished. Throughout California, SAF professionals have placed over 385 disabled persons in jobs which were previously not open to them. These people now work competitively with non-disabled workers because they use sensory aids which have been identified and researched by SAF.

In addition to identifying and researching job opportunities, SAF also offers employers consultation services on such things as: recruitment of disabled persons with appropriate job skills, identification of appropriate jobs, job retention, acquisition of sensory aids, and follow-up support services.

SAF has received a grant from the U.S. Office of Education to adapt educational software for visually impaired children on the Apple computer. We would like your child to have the opportunity to benefit from using a computer in his/her education. We will be adapting 3 software packages using the Echo II Speech Synthesizer. This synthesizer will provide voice output so your child will hear the information on the screen. The 3 programs will be in the following areas:

1) Typing
2) Spelling
3) Sentence structure

We think this is a special opportunity for your child to benefit from the ever increasing use of computers in our society.

Because the grant from the Office of Education is a research grant, we shall be measuring your child's progress in spelling and sentence structure. We shall also be giving pre- and post-tests in keyboard proficiency and computer literacy. Your child's teacher will fill out a questionaire, a copy of which is included with this letter (for your information only). Your child will receive approximately 30 minutes computer time per week for approximately 16 weeks. The study will be conducted so as not to disrupt your child's regular classes.

We shall be presenting the study results in articles for both professional and consumer journals, as well as at conferences for computers and education. At no time will your child's name be used, nor will your child's results be singled out. Each child will be assigned a code number to protect his/her identity, and only Susan Phillips, Project Director and Andrew Renouf, Project Assistant, will have access to the master list of children and their code numbers. Your child's results will be completely confidential. If at any time you wish to withdraw your child from the study, you may do so.

Let us add that we are both deeply committed to this project and believe it will be of great benefit, not only to your child but to all visually impaired children. At your request, we will send you a copy of one of the articles resulting from this study when it is ready for publication, sometime in the summer of 1984.

Please read and sign the enclosed consent form and mail it, along with the completed Parent's Questionaire, to Sensory Aids Foundation in the enclosed stamped, addressed envelope. Please return both forms within one week as we need the signed consent form in order to start the computer instruction with your child.

If you should have any further questions, please feel free to call Susan Phillips, 415/329-0430 (9am - 5pm), or Andrew Renouf, 415/326-9208 (after 5pm), and we will be glad to respond. We would like to thank you for your anticipated cooperation in this project. Without your help this research would not be possible.

Sincerely,

Susan H. Phillips

Susan H. Phillips
Director of Development &
Project Director

Andrew G Renouf

Andrew G Renouf
Project Assistant

SHP/AGR:js

Sensory Aids Foundation has my permission to work with my child,

_____, at _____
Child's Name School

on the Apple Computer Accessibility Project for visually impaired children.

I have read the letter of explanation and understand that I can remove my child from the study at any time. I also understand that Susan Phillips, as Project Director, and Andrew Renouf, as Project Assistant, are responsible for the project, and if I have any questions at any point of the project I am encouraged to contact them at 415/329-0430.

_____
Parent/Guardian Signature

_____
Date

Dear Parent(s)

Please take just a couple of extra minutes to answer the questions below. We are collecting this additional information in order to help us interpret our final results and to give us a better sense of perspective on what we find. As stated in the letter of explanation, all information will be strictly confidential. Your child's name is needed on this form only for purposes of matching the data with the correct subject information. Once again we would like to thank you for your cooperation in this study, without it such research would be impossible.

Sincerely,

Susan H. Phillips
Project Director

Andrew Renouf
Project Assistant

SUBJECT INFORMATION QUESTIONAIRE
(To Be Completed By The Parent)

Child's Name _____ Code # _____
(SAF use only)

1) Do you own a home computer? Yes_____ No_____

2) (If "yes" to question #1) How long have you owned a computer? _____
Will your child have access to it during this project? Yes____ No____

(If "no" to questions #1) Do you plan to purchase a computer?
Yes _____ No_____

3) No time commitments are demanded of the parents by this study. If this were not true however, how much time could you devote to helping your child per week? Please check one.

Less than 1 hour _____ 1 to 2 hours _____ 2 to 3 hours _____

3 to 4 hours _____ 4 to 5 hours _____ 5 to 6 hours _____

6 to 7 hours _____ More than 7 hours _____

May 30, 1984

Dear Parents:

Thank you for allowing your child _____ to participate in our exciting computer project. _____ has made tremendous progress since the beginning of the program.

I am writing to you at this time to request that you grant permission to show slides of your child when I present information at meetings or conferences. In addition, there might be a chance that your child's photo would be requested for a newspaper article. If this does happen I will be happy to send you a copy of the article.

Please complete the bottom portion of this letter and return it to me. Please keep the second copy for your records.

Thank you for your cooperation.

Sincerely yours,

Susan H. Phillips
Project Director

I do give my consent for Sensory Aids Foundation to use photographs or slides of my child _____ for any purpose (as mentioned above) without compensation to me or my child.

Parent's name _____ Parent's Signature _____

Address _____

Date _____

Appendix G

Minutes of the Advisory Committee Meetings

BEST COPY AVAILABLE

Sensory Aids Foundation
399 Sherman Avenue, Suite 12
Palo Alto, California 94306

"Making Apple Computers Accessible
To Blind Children"

Minutes of
Advisory Committee Meeting
Thursday, October 6, 1983

The meeting was called to order by Susan Phillips, Project Director at 4:00PM. Members present were Peggy Barker, Robert Bowers, Renée Child, Sandy Curry, Rick Gordon, Phil Hatlen, Susan Phillips and Andrew Renouf. Also present was Marjorie Linvill, President, Board of Trustees, Sensory Aids Foundation.

I. INTRODUCTION

Susan welcomed the Advisory Committee members present on behalf of the Project and the Foundation. She asked those present to introduce themselves with a brief statement of their background.

Ms Peggy Barker, Manager
Communication Service Research
Children's Hospital at Stanford

Dr. Robert Bowers
Dept. of Special Services
School of Education
California State University, Sacramento

Ms Renée Child
Teacher of the Visually Handicapped, San Jose

Ms Sandra Curry
Past President, ADVH and
Teacher, Fremont High School

Mr. Richard M. Gordon
Programmer and software consumer

Dr. Phil Hatlen
Professor of Special Education
Dept. of Special Education
San Francisco State University

Mr. Andrew Renouf
Student, Stanford University

Susan announced that there were two other members of the Advisory Committee who were not able to attend due to previous commitments. They are:

Dr. David T. Uslan
California State Department of Education

Ms Elizabeth Weal
Publications Manager
Apple Computer, Inc.

II. FOUNDATION'S ROLE

Marjorie Linvill welcomed the Committee on behalf of the Board of Trustees of the Foundation. The Board is most appreciative of the interest shown by and the expertise possessed by the members. Marjorie gave a brief resume of the history of Sensory Aids Foundation and a capsule report of the accomplishments of the Foundation in the area of developing employment opportunities for the blind and visually impaired in California. The Foundation is very interested in this program because the staff is well aware of the increasing need for computer knowledge and the importance for the visually handicapped to learn to live in a sighted world. The children participating in this Project will be able to enjoy the same advantages as their sighted peers and hopefully be able to continue interaction with computers as they continue their educations.

III. PROJECT GOALS AND OBJECTIVES

Susan Phillips, Project Director, discussed the general outline of the Project:

I. Purpose of Project
   A. Goals
   B. Questions to be Answered
II. Parameters of Project
III. Background and Need
IV. The Project
   A. Phase One: _____ to _____
      1. Selection of students (Criteria)
      2. Selection and development of materials, equipment and procedures
      3. Preliminary field test of material, equipment and procedures
      4. Development of pre-tests

   B. Phase Two: _____ to _____
      1. Pre-test population
      2. Teach and demonstrate

3. Gather data
   a. Objective measures
   b. Subjective measures
4. Analyze data for correlations and apparent trends

C. Phase Three: _____ to _____
1. Present findings to Advisory Committee for discussion
2. Make recommendations
3. Write final report

The overall goal of the project is to modify three pieces of software which would enable blind children in grades 3-6 to participate in the computer activities in the public school systems in the San Francisco Bay Area. Investigation showed that the software programs available in the public domain were not satisfactory. Educational software programs are being developed in various parts of the United States. Because the technology currently available cannot allow any software package to work with speech output, a decision was made to adapt three software packages that would most benefit blind children. The three packages chosen are:

1. "Master Type". This software has been developed by Lightning Software of Palo Alto, CA. The children participating in the Project will need to know how to type to use the computer terminal, and because of the age level, they will not have sufficient skills in this area. Therefore it is considered appropriate to begin with this program.
2. "The Spelling Program". This software has been developed by TEACHING TOOLS - Microcomputer Services of Palo Alto, CA. Also because of the educational level of the children involved, it is considered necessary to assist regular classroom work with this program. One of the objectives of the Project is to develop skills in the area of "language arts" and not to teach programming. The Project wishes to demonstrate that blind children can become competent in the area of computer literacy and develop into productive citizens in a computer-oriented society. This program will give children practice with different spelling lists. The lists can be easily changed by the teacher.
3. "Sentence Structure". This software program has not yet been selected. Several programs are being investigated, and a decision will be made by Spring 1984.

The following criteria for the selection of subjects were determined:

1. Geographic location
2. Age at onset of visual impairment
3. Present degree of vision
4. Stability of vision
5. Age
6. General level of intelligence (functionally defined)
7. Motor skills
8. Academic achievement

9. Grade in school
10. Degree of experience with technology
11. Keyboard experience
12. Auditory skills and experience
13. Ability to work independently
14. No additional major impairment
15. Future access to computers

IV. PROJECT EVALUATOR'S ROLE

Robert Bowers, Project Evaluator, discussed the role of the evaluator in the project. It is anticipated that the Evaluator will work closely with the Project Director and the Programmer in the development of the software programs. At the onset of the Project he will conduct a "skills evaluation" of the participants. Midway in the project he will, in consultation with Project Director, effect a "mid-course realignment", and at the end of the project he will survey the results to determine correlations, trends, and effectiveness of the Project. Bob Bowers strongly recommended that the breadth of the project be narrowed to a feasibility study. The subject area is too broad and needs preliminary data to be truly meaningful in final results. The recommendation was made that Susan Phillips renegotiate the scope with the Special Projects Division, U.S. Department of Education.

V. PROJECT ASSISTANT'S ROLE

Andrew Renouf, Project Assistant, discussed his role in the Project. There will be a study plan constructed for evaluation of the Project which will facilitate the acquisition of information at the beginning and end of the Project for comparison. Data will be gathered to measure spelling, typing, sentence structure, etc. Andrew believes that the Project will probably end with many potentially interesting future projects.

VI. EQUIPMENT & SOFTWARE DEMONSTRATION

Rick Gordon explained and demonstrated the various components of the Apple IIe - the computer being used for the Project. He recommended that a choice be made as soon as possible as to the speech synthesizer to be used with the Apple. There is not enough time in the Project to compare both synthesizers with the children. This selection of equipment would make the programming move along at a faster rate. He gave his opinions as to the values and comparative costs of both the Votrax and Echo speech synthesizers. The Committee agreed that Susan will contact those persons known to have used both speech synthesizers, and a decision will be made based upon those judgements.

VII. DISCUSSION

A discussion of the various software programs followed. There was general agreement that none of the programs were entirely satisfactory, but that the Spelling Program could be used without change even though

the element of interaction was missing. There was agreement that "Master Type" could be adapted to prove satisfactory for Project use. Rick also voiced his opinion that the scope of the Project could well be limited to a feasibility study with a follow-up program to develop specific programs.

There being no further discussion, the meeting adjourned at 6:15PM.

SENSORY AIDS FOUNDATION
399 Sherman Avenue, Suite 12
Palo Alto, California 94306

A Project To Make Apple Computers
Accessible To Blind Children

Advisory Committee Meeting
of
Friday, March 2, 1984

Minutes

The meeting was called to order by Susan Phillips, Project Director, at 3:00pm. Present were Georgie Lee Abel, San Francisco State University, Robert Bowers, Project Evaluator, Richard Gordon, Programmer, Marjorie Linvill, President, Board of Trustees, SAF, Jan McKinley, SAF, Susan Phillips, Marge Quackenbush, parent of a visually impaired child, Andrew Renouf, Project Assistant and Fred Schulenburg, parent of a visually impaired child.

I. PROJECT REVIEW

Susan Phillips reported on Project activities since the last meeting of the Advisory Council. Altnough the original intent of the Project was to modify existing educational software for use by blind children, it very quickly became apparent that the educational software in use in the schools, and other software packages available in the public domain, were not adaptable for the speech changes required. In one case it was possible to obtain permission to modify a controlled software program. (MasterType by Lightening Software)

Three software packages are being made available during this project. The first to be presented to the children was the typing program. The intent of this program is to bring the typing capability of each child to a level at which he/she can benefit from the program since computer access is through a keyboard. It is hoped that each child can reach typing speed of 25wpm. However, children do not need a typing speed of 25wpm to use the spelling program. A slight difficulty has arisen in that some of the children's hands are quite small (3rd graders in particular) which means a bit of difficulty in reaching the outside keys with strength and confidence.

The second program to be used is the spelling program. This program has proven very interesting to the children who are now using it because they can enter their classroom spelling lists and personalize the file with their own name. An interesting feature of this software

is that the program creats two separate spelling lists. On one list the word is entered and spelled correctly. The user (child) can then listen to the word, using the Echo II speech synthesizer. If the "spoken" word is not clear to the child, the child can re-enter the word phoenetically until it is recognizable to the ear. They are, in fact, programming the computer to their specifications, and this creates interest and enthusiasm in the children.

The original plan for the Project was to modify a language arts program for the third computer program. No suitable program has been found, and after consulting with teachers and resource persons, it has been decided that the most useful language arts technique would be to develop proficiency in the use of suffixes. This program is in the process of completion. Minor changes in the programs have surfaced in the course of usage and are being corrected, but overall the completion of the programming is consistent with the planned schedule.

Practice sessions have commenced with the children in the San Bruno and San Francisco schools. Work with the children cannot proceed until the preliminary testing has been completed, and although all permission sheets have been received from the parents, the test results have not been received from the Cupertino and San Jose teachers. San Jose teachers have been extremely difficult to contact and therefore delayed the students in beginning their computer time for this Project.

The preliminary tests administered are the Minnesota Computer Literacy Test and the Stanford Achievement Test. The Minnesota Test was slightly modified for use with younger children (i.e."boys and Girls" instead of "men and women"). The Stanford Achievement Tests consist of two sections: language arts and spelling. The children were tested at the appropriate grade level. The listening test is the Wepman Word Discrimination Test. The test administered for typing skills is a standard typing test. The Minnesota Computer Literacy Test consists of four sections: enjoyment, anxiety, efficacy (child's assessment of his/her ability), and sex-typing (stereotyping). The scoring range for the Minnesota test is 5 (low) to 25 (high). Of those tests administered, the average score for <u>enjoyment</u> was 24.0, <u>anxiety</u> was 11.8, <u>efficacy</u> was 17.6 and <u>sex-typing</u> scored 13.8.

The children from San Bruno and San Francisco have proven to be a highly motivated, enthusiastic group. Children who previously have been unmotivated by other means are jealous of their time at the computer and wish for more. The scoring on the Wepman hearing test averaged 20 out of 30 words. Bob Bowers suggested that an improvement in the speech presentation might improve the scores, and that it might be prudent to give the tests again under more controlled conditions. The use of earphones would eliminate background noise and allow more concentration on the part of the child. Georgie Lee Abel suggested that the quality of speech would certainly influence the listening skills results.

Susan reported some interesting early results of the classroom experience. It is apparent that the totally blind children generally have

good keyboard skills (typing instruction usually begins in the fourth grade for blind children), while the partially sighted children tend to try to rely on limited vision to see the keyboard and therefore are struggling.

The programs are proving to be highly motivating to the children. For one child the work with the computer has made a great difference in his motivation. The children compete with each other and with themselves in trying to improve their performance.

The Project's work schedule allows 30 minutes per child per week on the computer. The children would really enjoy, and benefit from, more time to practice. The schedule ends at the end of May. There is concern regarding the Cupertino and San Jose students because of the difficulty of reaching the teachers (they are itinerant resource teachers who go from school to school). The testing has not started. The concern is that there will not be enough time to work fully with the children before the end of May. It was suggested by Mrs. Quackenbush that the Cupertino Summer School Program could be utilized for completion of the project in those cities. This aspect will be investigated.

A short discussion was conducted concerning ideas for a continuation proposal to be presented to the U.S. Department of Education to continue the research. Several suggestions were made for possible incorporation into such a proposal. One suggestion was to conduct an auditory discrimination study comparing the Votrax and the Echo II speech synthesizers from the viewpoint of the users. Another suggestion was to plan on an early typing schedule using headphones and covered keys to be held in the schools 3-5 periods per week. The proposal should stress the dependency on the various school districts cooperation, the necessity to produce software for use by blind children and the lack of suitable off-the-shelf software.

II. SOFTWARE DEMONSTRATION

Susan Phillips and Rick Gordon, Project Programmer, demonstrated the two programs in use by the children. As a result of loading of the program, the Committee offered the opinion that an auditory signal would be useful to inform the user that the program was loaded and useable. However, the children can tell by the sound of the computer when it is ready to use. It is a simple addition to make to the program, and Rick will incorporate such a signal.

Typing Program Discussion

Rick described the evolution of the typing program. The programs in use in the public domain were considered uninteresting and unsuitable. Those programs which were available and less boring incorporated a great deal of graphics description and motivation. The decision was made to adapt MasterType (a typing program) and agreements were made with the copyright holder. The graphics were adapted to coincide with pitch changes i.e. the more urgent the action becomes, the tone gets higher and higher instead of a visual marker getting closer and closer.

After using the program with the children for several sessions, it has become apparent that some prior basic typing skills are necessary to fully utilize the program. There is a rhythm generated by the program which cannot be used to advantage unless the children have basic knowledge of the homerow on the typewriter keyboard. It was suggested that an auditory method of teaching typing skills is very satisfactory. A question was raised as to why speed is such a necessity for using the computer and why 25wpm was decided upon as a benchmark. Does speed have relevance to the spelling program? These questions will be considered during the next few weeks.

Spelling Program Discussion

The children did have tapes of the voice instructions so they could become accustomed to the sound of the speech synthesizer prior to beginning the spelling program. The program basically consists of two lists which are saved by the computer. The one list consists of the words correctly spelled and acts as the checklist for the answers. The second list is the spelling list entered into the computer and from which the speech synthesizer will "speak" the words for testing. The program has the capability of allowing the "re-spelling" of words phonetically to make for more understandable speech output from the Echo II. The children can make the adaptations themselves, and it makes for an exciting challenge which they enjoy.

The children do not seem to have a preference as to pitch, but a number of them found the presentation speed not to their liking. Modifications will be made to the program to allow adjustment of the speed of the list presentations - especially the "incorrect", or answer list.

III. DISCUSSION

The general discussion which followed the software demonstration brought about some suggestions for future consideration.

The design of the suffix program is planned to emphasize a drill concept of learning and probably multiple choice questions. The basic material would be prepared by the teachers to coincide with classroom work.

Efforts should be made to "fine tune" the pronunciation. This might involve more words and therefore, make the time required longer. However, the assistance to the children, and the enhanced validity of research results, would be worth the extra time expended.

In the interests of clarity, the number of commands should be kept to a minimum.

There being no further discussion or business, the meeting adjourned at 5:15pm.

SENSORY AIDS FOUNDATION
399 Sherman Avenue, Suite 12
Palo Alto, California 94308

"Making Apple Computers Accessible
To Blind Children"

Minutes of the Advisory Committee
Meeting of June 27, 1984

The meeting was called to order by Susan Phillips, Project Director, at 10:00am. Advisory Committee members present were Peggy Barker, Robert Bowers, Sue Mendiara, Susan Phillips and Fred Schulenburg. Also present were Richard Gordon, Programmer, Andrew Renouf, Project Assistant, Marjorie Linville, SAF Board of Trustees, Ted Clarke, SAF Intern and Kathy Sullivan of Pickett Sales (Apple Distributor).

Susan announced that this meeting would be the last meeting of the Advisory Committee. The termination date of the project is July 31, 1984.

She also announced that the cost-sharing requirement of the project had been achieved through in-kind contributions of the Advisory Council members. Kathy Sullivan, Fred Schulenburg, and Peggy Barker will complete the necessary form at the end of the meeting.

Copies of the March '84 SAF Quarterly Journal were distributed. This issue contains an article describing the experiences of the children using the computer and software at the El Crystal School in San Bruno, California. Susan also announced that all the schools except the Lawton School in San Francisco have the necessary equipment to continue the classes next year. There has been some monies received as a result of the television exposure on Channel 7 news but not enough to buy the equipment for the children's use. This is a disappointment as the children were making great progress. The software will be given to the teachers to enable them to continue the program.

A number of the children have written letters to Susan, the "computer lady", to express their interest and enthusiasm in learning to use the computer. One such letter was read from Kim, a 5th grade student at Lawton School, San Francisco.

This letter was especially appreciated because Kim had been very quiet and undemonstrative in class, and she expressed her delight in the work with the computer.

I. Demonstration of Software Programs

Spelling Program

Rick Gordon demonstrated how the spelling program is set up. Some words must be entered phonetically in order to be recognizable when spoken by the speech synthesizer. The program was not as friendly as anticipated because the thought was that the teachers would create the list. However, the children did the programming themselves which resulted in the spelling program being the favorite because they were more involved in the operation.

The capability of speeding up the word presentation is incorporated in this program. Several of the children regularly speeded up the presentation while others never did.

Language Program

Rick demonstrated the language program. This program proved to be very interesting to the children also. They could do the programming themselves, but it took longer to do. Sue Mendiara, one of the teachers involved in the project, thought this to be the best program because it could be used for all phases of language arts. Sue had purchased a number of books which were full of ideas to enhance the program. Sue Mendiara also suggested that the ability to change the pronounciation of words would be helpful. Rick said that this could be done, but it woud take twice the room in the program to tag and change words that are difficult.

Discussion following the presentation of the software programs produced the following questions:

Q. Is the time limit a pressure on the students?
A. It depends on the student's personality.

Q. Would more frequent use of the computer be more helpful i.e. take it home?
A. Not sure of that, but it is an interesting question. We noticed an increase in motivation level as students worked more with the equipment. The higher voice turned the children off, and it seems that it is a counterproductive technique.

Several observations were forthcoming from the discussion:

1. Missed questions could be repeated. This would be helpful from an education point of view.

2. It would be useful to have the capability of a braille print-out. It was suggested that a Cranmer Brailler be added to the equipment.

3. Computers have become an important factor in the children's outlook regarding career plans. A desire to learn to program has been expressed by one child.

4. The students have developed an interest in the hardware itself, and they expressed a decided preference for the keyboard of the Apple IIe - noting the different touch.

5. Bob Bowers expressed the opinion of the group in saying that he was impressed with what has been accomplished in a short time.

II. Slide Presentation of Children

Susan showed slides of the children using the computer and software. The slides captured the enthusiam with which the youngsters applied themselves. Susan reported that the amount of progress each child made was dependent upon the amount of practice they had and what else was going on at the school.

Following the slide presentation a discussion developed as to how to acquire a computer for Lawton School. All of the other participating schools are planning to continue the program next year. On the June 8th telecast on Channel 7 news, KGO, Susan made a plea for funds to acquire a computer for Lawton. This telecast resulted in eight responses - mostly with suggestions for fund raising. The sale price of the Apple computer is $895 at the present time (educational discount price).

The suggestion was made to make a video tape to be sent to prospective contributors or donors. It was suggested that a tape be sent to John Scully and Steve Jobs at Apple Computer.

The principal of Lawton School is a member of the Lions Club, and it was suggested that a tape be sent to him as a Lions Club member. The Lions are interested in donating equipment, rather than money, and this seems a logical point of contact.

It was also suggested that it might be possible to locate someone who would be willing to donate a used, older model computer after up-grading their system. Such a contribution can be used as a tax write-off for the contributor.

C-TEC is holding a demonstration for Apple dealers of adaptations to the Apple computer which enable the blind and visually impaired to input and output the computers. Susan will show the taped KGO presentation at that time.

III. Review of Testing Results for Visually Impaired Children and Discussion of Progress Made Throughout the Year

Andrew Renouf, Project Assistant, reported on the results of the testing of the children participating in the Apple project. Bcause of the small number of students in the subject pool and the large number of experimental variables, the statistics developed are difficult to determine a true valid measure. However, the findings were interesting. Some of the most interesting are:

1. All students raised their typing scores as determined by the pre- and post-tests - a few children increased their speed two or three times the original rate.

2. The results of the Minnesota Computer Literacy Test (enjoyment, anxiety, efficacy and sex-typing evaluations) indicated that the enjoyment factor either did not change or rose significantly. The anxiety factor decreased markedly and the efficacy (child's assessment of his/her ability) went up in the scoring.

3. It was very apparent that the children were motivated by the opportunity to use their name in their work and thereby personalize their input. The feedback from the computer was also a strong motivating factor.

Bob Bowers closed the discussion by stating that the results of the project demonstrated that there is a larger field of application beyond the visually impaired. Educational software of this kind has great potential in the education of the learning disabled and others.

IV. Discussion of Future Ideas for Project Results

The Advisory Committee felt strongly that the results of the project were of sufficient value, and the software of significant worth, that it should be made available to as wide an audience as possible. The first determinaton must be as to who owns the software. It was generally conceded that because of the funding of the project by the U.S. Government, the software belongs to the Government. However, Bob Bowers suggested that the copy submitted to the Government be stamped "Not For Distribution" and the report be written

in very general terms so as to not disclose any new ideas or changes. Changes to the software will be the property of the creator of the changes.

Susan Phillips would like to make the software available, as it is currently written and without improvements. The price will be determined at a later date. The usual cost of programs such as these is about $30.00.

In the interest of wide distribution of information about the software, a discussion followed as to how to get the information to the appropriate people.

Some of the Advisory Committee members will be attending the Alliance meeting in Nashville in July. They will advise the members that the software is available. Susan Phillips will be making a demonstration of the software at SAF in July for anyone who wishes to see and hear the finished work.

Articles regarding the software will be submitted, with pictures, to a number of publication i.e. Journal of Visual Impairment, Infoworld, Closing the Gap, CUE.

The material will also be sent to appropriate publishers i.e. Scarborough Systems, Addison Wesley.

Susan will be contacting LINC in Columbus, Ohio.

Apple Computer publishes an educational newsletter, and information and pictures will be submitted to them for publication.

CEC (Council for Exceptional Children) is meeting this fall in Disneyland, California. Bob Bowers will send information on this meeting to Susan Phillips, and Susan will submit a paper to the CEC for presentation at this meeting.

The Advisory Committee gave their addresses for the summer to Susan Phillips so that the final report of the project and any pertinent up-date materials can be sent to them.

Everyone expressed their interest in serving on the Advisory Committee for this project, and their pleasure in the results.

There being no further business, the meeting adjourned at 12 noon.

Appendix H

Photos of blind children

Michael, 3rd grade student, Lawton School, San Francisco, working on the typing program

Michael listening to his score on the typing program - 40 out of 40. He increased his typing speed from 0-wpm to 19-wpm

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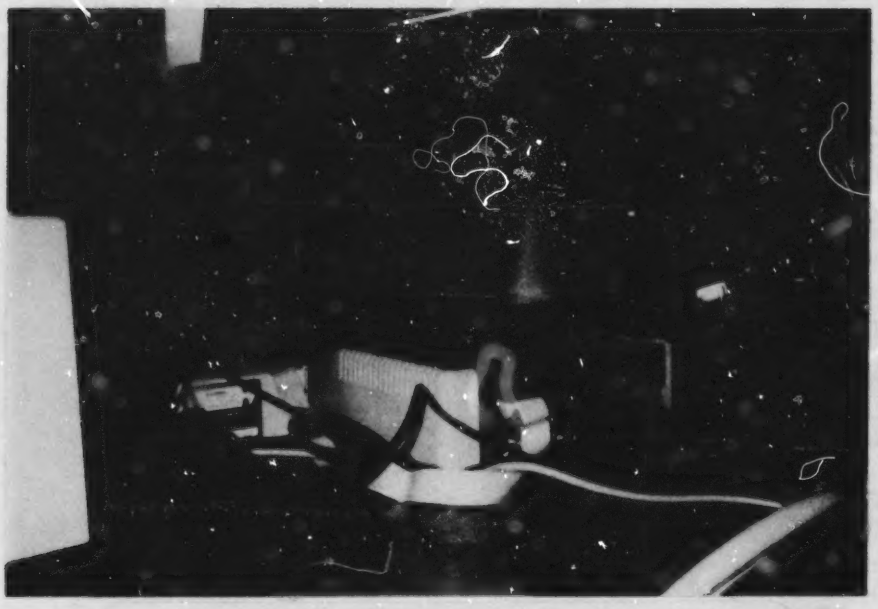
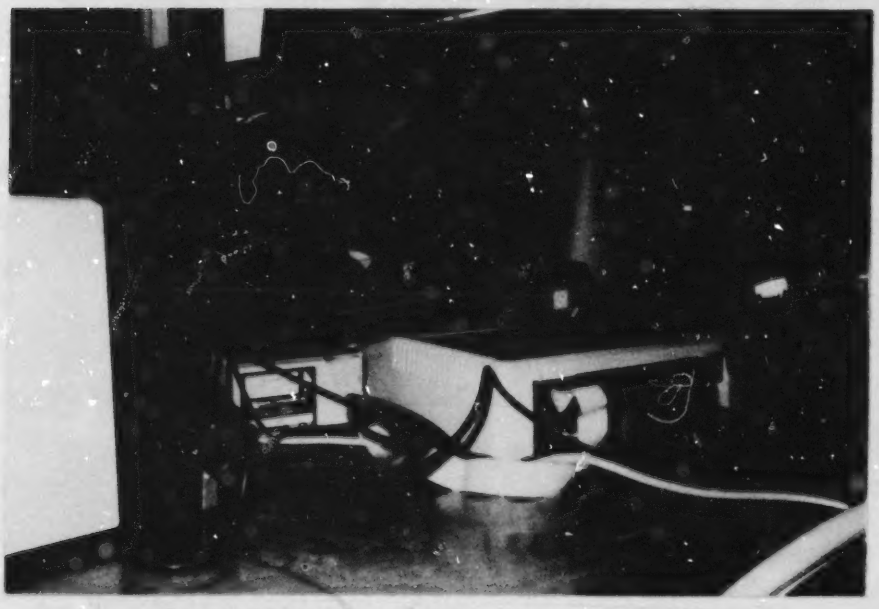


Corey, 5th grade student, Lawton School, San Francisco, working on the typing program



Corey listening to his score - 39 out of 40

Kim, 5th grade student, Lawton School,
San Francisco

Kim demonstrating the typing program to
her sighted classmates during their
computer fair

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Sighted 5th graders using the typing program during the computer fair

Appendix I

Letters received from
participating students

Apr 24, 1987

One thing I will Remeber

The one thing I will remeber is, Susan the computer
I like Susan because she taught me about the
I showed my class the computer one day
has a voice. The computer can talk.
the words and I write them.
computer helps me with my The computer
different keys on it. I have computer on
Wednesday. I am on lesson 12 I am ahead
of the kids. But they are catching up to me.
will remember Susan for a long time.

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Dear Mrs. Phillips,

I would like to thank you for helping us learn about the computer I think it was a good experience.

I hope that your baby is happy and healthy. It was very nice to have worked with you.

It was nice to have know you. I also had a wonderful time at the breakfast last week.

I hope to see you some day again perhaps when I go through the foundation to get a job.

May all of your projects that you and the foundation undertake turn out to be successful.

Sincerely,

Sandra Zeagas

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Appendix J

Software Descriptions
- Echotype
- Spelling Program
- Echotext

The ECHOTYPE Program

The ECHOTYPE Program was designed to give students practice in touch-typing. It uses a pre-stored set of eighteen lessons which proceed in difficulty from single characters on the home row of keys to complete words and BASIC programming commands. The program is based on the commercial program MasterType (TM) by Bruce Zweig. Mr. Zweig has given Sensory Aids Foundation permission to use the data files he developed for MasterType (the disk files which contain the letters and words used in the lessons) in the implementation of ECHOTYPE.

Background

In order to prepare visually-impaired students for the other programs in the Project (SPELL and ECHOTEXT), it was necessary to develop a program to teach the typing skills they would need to use those programs. Although the model for the typing program was MasterType, it was clear during the design phase that the new program would necessarily be very different, based on the needs of the visually-impaired student.

MasterType, like most currently-available educational software, employs complex graphics, color, and movement on the display screen to communicate information to the student. In ECHOTYPE information is communicated only through sound, in that, besides the pronunciation of the characters and words, only the pitch of the voice is varied. The other variables possible with the Echo II are volume (gain), and, to a limited extent, the speed of the spoken voice. The volume is not varied while using the program, and the speed of pronunciation, which may be selected as either "normal" or "fast", was maintained at the normal speed.

MasterType presents the user with a changing set of four words which must be typed. Each begins at a corner of the screen and moves toward the center of the screen until it is typed correctly, at which point it disappears and is replaced with a new word. This process continues until all the words of the lesson have been typed at least once. In ECHOTYPE, only a single word can be typed at any one time (rather than having the student choose which of four to type). Instead of using the progression of the word across the screen to indicate the passage of time, the pitch of the spoken word is increased as the word is repeated until the word is entered correctly.

The "scoring" in ECHOTYPE is based solely on the number of correct entries typed in during the lesson, and does not take the selected speed into account to calculate the score.

Running the Program

After starting the program the student is asked to enter his or her name, and is asked whether directions on running the program are necessary. If so, a short tutorial is presented which explains the entry of words (terminated by the "space" character), the scoring, and the use of changing pitch of the voice. If no directions are requested, the student is asked to enter the number of the lesson to be practiced (one to eighteen), and finally for the "speed" of the lesson (a number between one and ten). The speed entered determines how much time will be allowed for each correct typed entry. A higher number allows less time per entry than a lower number.

Next, the lesson is read from the disk, a process which takes about five seconds. The student is then told the number of words in the lesson, and the individual words are pronounced one by one, as they will be spoken during the lesson. When the student presses RETURN after a final prompt, the lesson begins.

For each word in the lesson, the word is spoken and the student attempts to type it before the word is spoken again. If the word is typed incorrectly, or if the word is not entered in time, the word is spoken again, this time in a higher pitch. After the word is typed correctly (or if the word has not been typed correctly before it has been spoken ten times), the next word in the lesson is spoken. This process is repeated until each of the ten words in the lesson have been typed four times. At the end of the lesson, the score for the lesson is reported, along with a (presumably encouraging) comment about the student's progress. The student can then either repeat the lesson, go on to another, or finish using the program.

The SPELL and RECORD Programs

The SPELL and RECORD programs were designed to permit an instructor or student to prepare a spelling lesson of up to twenty words, to save that lesson with a unique name on a disk, and to use the lesson in spelling drills. Because the Echo II speech synthesizer cannot translate written text into speech without error, two lists are stored on the disk for each lesson: one contains the words in their correct spelling, the other in a modified, semi-phonetic representation.

RECORD

The RECORD program begins (as do all the programs in the SAF series) by loading the Street Electronics Corp. "Textalker" speech synthesis program for the Echo II speech synthesizer. This step takes about 15 seconds. From this point on, communication with the user is through both the screen and the Echo.

Next, the user is allowed to alter the pitch of the voice and to change the speech rate, though this last adjustment is limited to "fast" or "slow". Most users begin using the slow rate until they become accustomed to the Echo's manner of speech, then switch to the faster rate.

Next, the user is asked for the number of words in the list being created, in the range one to twenty. For each of the words, the user is asked to enter the correct spelling first, then an optional modified spelling if the Echo can't pronounce the correct spelling adequately. This a trial-and-error process, with the user trying various phonetic spellings until satisfied with the pronunciation.

When all the words have been entered, the complete list is displayed on the screen and pronounced as the words are displayed. The user then has the option of changing the (correct) spelling of any of the words. It is assumed that the pronunciation, at this point, is correct, but that errors may have been made in the correct spelling of some of the words. After each correction, the word list is again displayed and spoken, until the user is satisfied that the list is correct.

The user is then asked for a name for the word list. This name is used as the file name on the disk. The file is written to the disk and locked. (The "locking" process assures that the file won't be accidentally erased. To erase the file it must be "unlocked" by issuing the proper command to the Apple operating system.

Finally, the user is asked whether he or she would like to create another word list. If so, the process begins again at the point where the number of words in the list is asked. If not, the user is thanked and reminded to use the list with the program SPELL, and the program ends.

SPELL

The SPELL program, after loading the speech synthesis routines, asks the student to enter his or her name. This name will be used throughout the program at appropriate times. The student is then asked whether the characteristics of the voice (the pitch and speed) should be changed. If so, pitch and speed can be adjusted individually.

Next, the student is asked for the name of the word list stored on the disk. If the name is entered incorrectly (or if the named file doesn't exist on the disk currently in the disk drive), the program exits and must be restarted.

The student is next told how many words are in the list he or she has selected, and is given a brief series of instructions. Each will be spoken, accompanied by a "beep" from the Apple's internal speaker. As each letter is typed in it is spoken; the end of the entry is indicated by pressing the RETURN key. If the student wants to correct a letter before pressing RETURN, the "left arrow" key is used to back up to the incorrect letter(s). If the student wants to hear the word again, the RETURN is pressed alone. If the student wants to hear the instructions again, RETURN is pressed twice.

After entering each word, the student is told either that the word is correct, at which point the next word is spoken, or that it is incorrect. Then the word is spoken again and the student is given another chance to enter it correctly. If the word is entered incorrectly twice in succession, the student is given a "hint": the letters correctly entered (in the correct position in the word) are spoken, and the program pauses, then waits for the student to press RETURN to continue. If the word is entered incorrectly again, the program moves to the next word in the list.

At the end of the list, the student is told the score (number correct out of number attempted), and is told which words were missed. These words are spelled letter by letter individually. The student is then given the opportunity to try the list (or another list) again; if so, the program asks for the name of the list and repeats from that point. If not, the program ends.

The CREATE and ECHOTEXT Programs

ECHOTEXT is a general-purpose language arts testing program in the form of a multiple-choice quiz. The CREATE program generates the disk files which are used as the lessons to be used with ECHOTEXT. Though CREATE was designed to be used by an instructor, it can also be used by students to prepare practice lessons for individual study. CREATE communicates with the user through the Apple keyboard and display screen, and does not use the Echo II speech synthesizer, and so is not appropriate for the vision-impaired. student.

CREATE

The CREATE program begins by asking if the user needs instructions. If so, a brief tutorial is displayed explaining the use of the program.

The user is asked for a file name to store the lesson to be created on disk, and for the number of questions in the lesson (with a maximum of twenty questions). Next, an introductory paragraph may be entered which explains the subject to be covered in the lesson. The paragraph is entered as it is to appear on the screen (and as it is to be spoken by the Echo II). The end of the paragraph is indicated by entering the "number" character "#".

The user is then prompted to enter the first question in the lesson. The question can contain up to 255 characters, or about six lines of text on the screen. As with entering the introductory paragraph, the question is terminated with the # character. The user is next prompted for the number of choices for the current question (with a maximum of five choices per question). Next the individual choices are entered (each terminated with the # character). After all the choices have been entered, the user is prompted to enter the number of the correct choice. This procedure is repeated for all of the questions in the lesson.

When all the questions and choices have been entered, the user is asked to enter the name of the lesson; this name will be saved as the name of the file on the disk. When the file has been saved successfully on the disk, the program ends.

ECHOTEXT

The ECHOTEXT program, after loading the speech synthesis software, asks the student to enter his or her name, then to enter the name of the lesson to be studied. If the named file

cannot be found on the disk (or if the name was entered incorrectly) the program terminates and must be restarted. The student is then told how many questions are in the lesson, and prompted to press RETURN when ready to begin the lesson.

The introductory paragraph is read from the disk and displayed and spoken. When the student presses RETURN, the first question and the possible choices for that question are displayed and spoken. If the student does not respond with the number of the correct answer, the correct number and its associated answer are displayed and spoken. This process is repeated for all the questions in the lesson.

When all the questions in the lesson have been covered, the student is told his or her score (number correct out of the total number of questions), and is asked whether to repeat the current or another lesson. If so, the program repeats from the point it asks for the name of the lesson. If not, the program ends.

Appendix K

SAF Quarterly Journal
March, 1984
page 2
"Personal Computing Offers New
Potential To Visually Impaired Children"

Sensory Aids Foundation

Quarterly Journal

MARCH 1984

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A MESSAGE TO OUR READERS

Through these Quarterly Journals we report on the status of our programs: the funding, the objectives and the results of each major program area.

In this issue we shall provide vignettes of people receiving services through these programs. Our intent is to demonstrate the power of technology, when appropriately applied, to unlock access to information not earlier accessible. The use of technology to solve problems for hearing and visually impaired persons is Sensory Aids Foundation's main objective.

PROGRAMMING IN LARGE PRINT

A graduate of the Center for Independent Living Computer Training Project in 1982, Kyle Parrish thought finding a job as a computer programmer would be easy. But entering the employment market during a recession, when employers could be very selective about hiring only experienced programmers, made it anything but easy. Parrish found that his visual loss and his inexperience in programming combined to create a major obstacle to getting his foot in the door. Today however, he is successfully employed as a Computer Programmer at Hewlett-Packard.

How did Parrish get to where he is today? In 1967 he lost most of his vision as a result of surgery. Although a small window of vision remained, it was not enough for Parrish to continue his work as a financial administrator, a job requiring much paperwork. He then decided to go into computer programming.

The Department of Rehabilitation counseled and trained him as a computer programmer. While in his training, he had work experience at Hewlett-Packard. He hoped that would cinch his placement at H-P. It did not because they had no openings when he graduated. After several months of unsuccessful job searching, Parrish was referred to SAF for assistance in finding a job and in determining the most appropriate computer aids to perform his work. SAF worked closely with Parrish referring him to jobs. SAF also conducted an evaluation of his visual limitations as they affected his ability to use a computer, and recommended a large print computer terminal for employment. In October of 1983, his past association with H-P paid off when he got an unpaid work experience in their international division. His successful volunteer work using a Visualtek large print Apple computer as a terminal for the H-P 300 main frame resulted in a permanent job offer in February. SAF is continuing to provide technical assistance in solving a new computer access problem dealing with interactive programming.

TECHNOLOGY IN EDUCATION

PERSONAL COMPUTING OFFERS NEW POTENTIAL TO VISUALLY IMPAIRED CHILDREN

Sandra, Marvelena and Michelle are classmates at El Crystal School in San Bruno, California, where they spend part of each day with Sue Mendiara, Resource Teacher for the Visually Impaired in San Mateo County. This story is an example of how these children with severe visual impairments can expand their learning capabilities with the help of a personal computer. Like thousands of children in classrooms across the country, Sandra, Marvelena and Michelle are now able to use an Apple computer.

The $50,000 grant from the U.S. Department of Education, Division of Education Services and Special Education Programs, has allowed Sensory Aids Foundation to develop two experimental prototype software packages for use by blind children. (A third program is currently under development.)

Before January, 1984 visually impaired children were unable to share in the excitement and fun of using publicly available microcomputers. Now the children are saying, "I think that the speech synthesizer is really neat, and I'm glad that we are able to use it." Marvelena, a 4th grader, went on to say, "I think that it is really fun to work with the computer now. My sister is working with it too, and I'm glad I can do some of the same things that my sister does. I think the computer is really fun, and I learn a lot from it."

The first program developed for the children was a typing program adapted with permission from the author and publisher of "Master Type". Our version uses the Echo II speech synthesizer to provide speech output for the 17 different lessons. Now, after three months of student evaluation and several modifications, we see children that have never been interested in learning how to type anxious for the "computer teacher" to arrive so they can practice their typing. Fourth grader, Michelle has said, "I like the computer. It was kind of hard at first. You learn how to type more. It makes me feel good because I'm learning how to type and some of the other kids don't know how to type and I can."

Positive results are also achieved through "mainstreaming" the children. "Basically, this means that the visually impaired children spend most of their day in regular classrooms and come to me as a resource during the day", says Ms. Mendiara. Ms. Mendiara was very excited when Susan Phillips, SAF Project Director, contacted her to ask for student software evaluators. "I have wanted my children to have a chance to use computers, and now I can see such positive results."

Marvelena completed one of the lessons on the typing program and then said, "I feel more a part of the kids in my regular class because I feel like a sighted person using the computer with the speech synthesizer. I can't wait to get to the Spelling Program".

RECENTLY BLINDED PROGRAMMER TAKES INITIAL STEP TOWARD RE-EMPLOYMENT

Last October, the Sensory Aids Foundation and the Western Blind Rehabilitation Center (a section of the Palo Alto VA Medical Center) jointly set up a training center to instruct blind and low vision individuals in the use of braille, voice and large print computer access devices. This joint project is called C-TEC, which stands for Computer Training and Evaluation Center.

C-TEC's first student was a computer programmer who was forced to resign from his position because of complications of diabetic retinopathy which prevented him from viewing the CRT screen. The student, a veteran in his late forties, had been working in the computer industry for some 20 years. After discussing the goals of the student, a plan was devised in which he began learning the Apple II Plus with the Echo II synthetic voice and the software package called BRAILLE-EDIT. The student spent a combination of 48 hours of direct instruction and independent practice on these devices. In addition, he did some exploring on his own, finding that while the Apple II Plus could meet his needs of programming in COBOL, the Apple III would be even better. The student has completed his training with C-TEC and has returned home to Southern California where he is using the combined services of the Vocational Rehabilitation Department of the Veterans Administration,

Sensory Aids Foundation and the State Rehabilitation Counselor to obtain employment as a computer programmer.

Veterans should be aware that the VA has not yet reached a decision toward processing the training and issuance of any of these computer access devices. This is still in the evaluation stages and any requests or input from veterans would be useful in assessing veteran needs.

Through Sensory Aids Foundation, evaluation and training services at C-TEC are provided to non-veterans on a fee basis. Also, one-hour demonstrations of equipment are available by appointment to interested consumers, employers, and rehabilitation and special education professionals. Persons interested in evaluation and training are encouraged to apply.

Non-veterans should direct requests to:

Jerry Kuns, Administrator, C-TEC
Sensory Aids Foundation
399 Sherman Avenue
Palo Alto, CA 94306
415/329-0430

Veterans should contact:

Jay Stiteley
Computer Reading Aids Specialist
WBRC (124)
VA Medical Center
3801 Miranda Avenue
Palo Alto, CA 94369
415/493-5000, Ext. 4369

TECHNOLOGY IN EMPLOYMENT

COMPUTERS AND COUNTRY MUSIC - A FINE COMBINATION FOR BLIND PRODUCTION ASSISTANT

The country sounds of KRIJ are heard throughout Chico and the foothills of Northern California's Sierra Nevada Mountain Range. KRIJ is a radio station in Paradise, California, and its new production assistant, Kevin Harkins, is blind. Kevin works the night shift and will soon be operating the station independently. Harkins, who has "one of those incredible radio voices" according to station manager Jan Claire, has to access KRIJ's Harris Computer system. To do this he will be using a Zorba 2000 microcomputer with a speech synthesizer and special software developed by Rohland Microcomputing.

Sensory Aids Foundation has worked with KRIJ from the start to ensure Harkins' success on the job. SAF visited the radio station to identify potential problems, and then coordinated the effort to get equipment and the necessary software. Currently plans are being made to get everything in place. In the near future, if you are in the Chico vicinity and hear Kevin Harkins reading the news and playing country music on the radio, you can be sure he's doing it on his own.

SCIENTIFIC PROGRAMMING AN EXCELLENT SOLUTION FOR HEARING IMPAIRED MATHEMATICIAN

There are times when everything goes right. "Pete" McCloskey, a member of the Board of Trustees of Sensory Aids Foundation, recently contacted several companies asking them to support SAF employment programs.

Finnigan Corporation was one of the first to respond with a commitment to hire one of our clients. SAF staff met with Chris Grotzinger and Ron Miller of Finnigan to explain SAF services and to establish a process to refer qualified applicants. One of the people we referred was William Michael. Mr. Michael has a Ph.D. in mathematics and several years teaching experience. However, he was forced to give up teaching because he developed a severe bilateral hearing loss which made it extremely difficult to operate in a classroom situation.

When the people at Finnigan met him, they were impressed with Michael's knowledge of scientific programming languages. He was hired as a Senior Scientific Programmer/Analyst. Finnigan has worked enthusiastically to ensure Bill Michael's success in his new job. They will provide the necessary accommodations to enable him to participate in departmental staffings and to facilitate communication between Michael and his co-workers.

Bill Michael has found himself an excellent job, and Finnigan Corporation has gained a valuable employee. But even more, the company has learned something — being disabled is not a reflection of someone's ability.

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Who We Are

Sensory Aids Foundation (SAF) is a non-profit corporation which puts technology to work helping disabled persons enter the job market. Throughout California, SAF professionals have placed over 400 disabled persons in jobs which were previously not open to them. These people now work competitively with non-disabled workers because they use sensory aids which have been identified and researched by SAF.

In addition to identifying and researching job opportunities, SAF also offers employers consultation services on such things as: recruitment of disabled persons with appropriate job skills, identification of appropriate jobs, job retention, acquisition of sensory aids, and follow-up support services.

Training is available for visually impaired persons to teach them to use specific computer access aids appropriate in his/her job.

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Appendix L

Article from
Instructor, April 1984

Copy To —
T. Tinsley
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COMPUTER CORNER *continued*

puter network. A Site License is good for one item of software; each is $35.

For more information on the Site License and a free catalog of EduSoft K-12 software, write EduSoft, PO Box 2560, Berkeley, CA 94702.

Premium programs

Hively's Choice, A Curriculum Guide to Outstanding Educational Microcomputer Programs for Preschool through Grade 9 is the first volume of what is expected to be an annual series of guides to the best educational microcomputer software. The 1983-84 guide features a description of 106 software programs in an easy-to-read format.

The guide was compiled by a national group of teachers and education consultants under the direction of Wells Hively, a former researcher in educational technology at Harvard. The book is available for $19.95 from Continental Press, Inc., Elizabethtown, PA 17022.

Software for the sightless

A demonstration project involving 18 blind and visually impaired students in the San Francisco area is bringing the world of computers to the blind. With a $50,000 grant from the United States Department of Education, the Sensory Aids Foundation in Palo Alto, California, has used existing software on an Apple IIe interfaced with a Street Electronics Echo II speech synthesizer. The synthesizer allows information normally displayed on the video screen to be spoken to the children.

Project coordinator Susan Phillips has been working with the third through sixth graders since January. Each was given a pretest in typing, spelling, listening, and language skills, then exposed to software designed to sharpen those same skills. Each student will also be given a post-test in June.

A report of the results of the project will be ready in August and will be available for a nominal fee. Plans for marketing software for blind and visually impaired computer users should also be under way by late summer. For information on the report and the software, send a self-addressed, stamped envelope in August to Susan Phillips, Sensory Aids Foundation, 399 Sherman Ave., Palo Alto, CA 94306; telephone 415-329-0430. □

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